CHARLES WILLIAMS STREAM, WETLAND, AND BUFFER SITE

EEP Project No. 80

MONITORING YEAR 1 (2014)

Construction Completed February 2013
Planting Completed February 2014

Alamance County, NC
State Construction Project No. 07-07125-01A

Prepared for the
NC Department of Environment and Natural Resources
Ecosystem Enhancement Program

1652 Mail Service Center
Raleigh, NC 27699-1652

FINAL REPORT June 2014

Prepared by:

ECOLOGICAL ENGINEERING

1151 SE Cary Parkway, Suite 101
Cary, NC 27518
919.557.0929
www.ecologicaleng.com

G. Lane Sauls, Jr., Principal

Under Contract With:

SUNGATE DESIGN GROUP

This assessment and report are consistent with NCDENR Ecosystem Enhancement Program Template Version 1.4 (11/07/11) for EEP Monitoring Reports.

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1.0 EXECUTIVE SUMMARY/ PROJECT ABSTRACT

The Charles Williams Stream, Wetland and Buffer Site, hereinafter referred to as the "Project Site" or "Site," is located in Randolph County, North Carolina, within US Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC) 03030003 and NC Division of Water Resources (NCDWR) sub-basin 03-06-09 of the Cape Fear River Basin (Figure 1). The project involved the restoration and/or enhancement of 1,850 linear feet of an unnamed tributary (UT) to Sandy Creek, 2.2 acres of wetlands and 8.8 acres of riparian buffer. The Site is protected for perpetuity under a conservation easement purchased from Mr. Charles Williams in 2006. Project restoration components, activity and reporting history, contacts and attribute data are all provided in Appendix A.

1.1 Goals and Objectives

The Project's goals were to:

- reduce nutrient and sediment water quality stressors;
- provide for uplift in water quality functions;
- improve instream and wetland aquatic habitats, including riparian terrestrial habitats; and,
- provide for greater overall instream and wetland habitat complexity and quality.

Stream enhancement, the primary component, served as the dominant input for achieving this goal.

No restoration goals were identified in the Cape Fear River Basinwide Management Plan (NCDWQ, 2005) with regard to the Sandy Creek watershed. There were no sources or stressors listed for the watershed area associated with the Project Site. The NC Department of Environment and Natural Resources (NCDENR) Ecosystem Enhancement Program (EEP) develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for EEP planning and restoration project funds. The 2009 Draft Cape Fear River RBRP identified HUC 03030003020010, which includes the Project Site, as a Targeted Local Watershed. The following information is taken directly from the RBRP. "…This is a largely rural HU. The main stream, Sandy Creek, flows through Randolph County to Sandy Creek Reservoir, a drinking water supply for Ramseur and Franklinville. As of 2006, the HU had no streams on DWQ's list of impaired waters, however, the reservoir shows indications of high nutrient levels, likely related to the large number of animal operations in the HU. The HU is a Water Supply Watershed and a long portion of Sandy Creek is recognized by the State's Natural Heritage Program as a Significant Natural Heritage Area. EEP has been active in the HU with five projects that include components of preserving wetlands (3 acres) and streams (5,100 linear feet) and restoring wetlands (15 acres) and streams (15,000 linear feet). Piedmont Land Conservancy has also been active in protecting streamside buffers in the HU. Continued implementation of practices to reduce nutrient inputs to Sandy Creek Reservoir is recommended for this HU."

1.2 Background Summary

The Project Site is situated in northeastern Randolph County, approximately four miles west of Liberty and six miles north of Ramseur (Figure 1). It is bordered to the north and west by undeveloped land, the east by Ramseur-Julian Road and the south by Sandy Creek. Northeastern Randolph Middle School is on the property

opposite of Sandy Creek, to the south. The Project Site can be accessed by using the following directions from US Highway 64.

- Turn north on US 421 in Siler City, towards the Town of Liberty.
- Proceed approximately 9.5 miles and turn south (left) onto NC 49.
- Proceed approximately 0.7 miles along NC 49 and turn north (right) onto SR 2459 (Sandy Creek Church Road).
- Follow Sandy Creek Church Road approximately 4.5 miles until it intersects with SR 2442 (Ramseur-Julian Road) and turn north (right),
- Follow Ramseur-Julian Road approximately 0.3 miles, crossing over Sandy Creek. The Charles Williams Site is on the west (left) side of the roadway, immediately north of Sandy Creek.

Situated in the Piedmont physiographic province and the Cape Fear River Basin, the Project Site encompasses 18 acres of former pasture and existing riparian forest. Elevations across the Site range between approximately 550 and 560 feet above Mean Sea Level. The following chart depicts pre-implementation existing condition information regarding the Site.

Pre-Implementation Existing Conditions Summary

Physiographic Province	Piedmont	**County**	Randolph
River Basin Name	Cape Fear	**Property Owner Name**	Charles Williams
USGS 8-digit HUC	03030003		
USGS 14-digit HUC	03030002020010	**Stream #1 Name**	UT to Sandy Creek
NCDWQ Subbasin	03-06-09	**Drainage Area**	4.9 sq. mi.
Underlying Mapped Soil(s)	Chewacla loam	**NCDWQ Score**	(Perennial)
Drainage Class	Somewhat poorly drained	**Rosgen Classification**	C5
Hydric Status	B		
Slope	0-2 %		
Available Water Capacity	Moderate to High		
FEMA Classification	Zone AE		
Exotic Vegetation Observed	Multiflora rose (*Rosa multiflora*) Chinese privet (*Ligustrum sinense*)		

1.3 Vegetation Condition and Comparison to Success Criteria

Vegetation success criteria is consistent with the US Army Corps of Engineers Wilmington Regulatory District's guidance for stream and wetland mitigation and the NCDENR's guidance for riparian buffer credit. The USACE guidance documents the survival of a minimum of 320 planted woody stems/acre after Monitoring Year 3 (MY3). A mortality rate of 10% will be allowed after MY4 assessments (288 stems/acre) and correspondingly, MY5 assessments (260 stems/acre). The NCDENR guidance documents successful riparian buffer credit if at least 320 native, planted, hardwood stems/acre (trees only) are surviving at the end of the MY 5.

Vegetation is currently being assessed using plot layouts consistent with the EEP/Carolina Vegetation Survey (CVS) Level II Vegetation Protocol. Stem count data is ascertained from 12 permanently placed 10-meter^2 vegetation plots (Figure 2). Assessments included counts of both planted and natural stems. Due to the timing of vegetation surveys, planted hardwood species that were unknown due to age, lack of bark formation, wildlife browsing of buds, etc. were included in the stem counts. These species will be identified during MY2 monitoring activities. Based on the current monitoring effort, seven of eight vegetation plots met the minimum success criteria established for MY3 stream/wetland mitigation criteria and 10 of 12 plots met the

criteria for riparian buffer credit. Appendices B and C depict more detailed information regarding the vegetation condition, including annual photograph comparisons.

Due to the random placement of vegetation plots, only one of the eight plots associated with stream/wetland credit is currently placed within the wetland enhancement area. The remaining seven plots are situated in non-wetland areas; however, based on current site conditions, three plots (Vegetation Plots #3, #7, and #8) may likely be in wetland areas by MY4 assessments. The locations of the current plots will be reassessed during MY4 activities.

1.4 Stream Stability/Condition and Comparison to Success Criteria

Enhancement (Level I) of the UT utilized natural channel design methodologies consistent with Priority Level IV stream restoration protocols. These protocols specifically include the stabilization of the existing channel in place. A minimum of two bankfull events must be documented within the standard five-year monitoring period. In order for the hydrology-based monitoring to be considered complete, the two events must occur in separate monitoring years.

Bankfull events were recorded during November 2013 and March 2014. Evidence of these events consisted of wrack material above the bankfull indicators along the channel and cork shavings within the crest gage present at approximately 36 and 30 inches, respectively. Annual photograph comparisons of the stream channel are depicted in Appendix B and hydrologic data associated with this year's monitoring assessment is provided in Appendix E.

1.5 Wetland Conditions and Performance Relative to Success Criteria

Wetland enhancement work was performed throughout the existing wetland areas. These wetlands were severely degraded as a result of continuous soil compaction and grazing from livestock. The enhancement work included livestock removal via exclusion fencing and supplemental plantings. Benefits include water quality improvement by trapping nutrients such as nitrogen and phosphorous, toxic substances and disease-causing microorganisms. Wetlands also slow and intercept surface runoff, protect stream banks from erosion, protect upland areas from flooding, as well as provide valuable habitat for wildlife.

1.6 Other Information

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

Boundary signage along the conservation easement area is limited and does not currently meet EEP guidelines.

2.0 METHODOLOGY

This monitoring report follows methodology consistent with EEP's Procedural Guidance and Content Requirements for EEP Monitoring Reports (Version 1.4, dated 11/07/11), available at EEP's website (http://www.nceep.net).

All surveys were performed via total station and survey grade Global Positioning System (GPS). Each survey point has three-dimensional coordinates and is geo-referenced. Longitudinal profile station was developed based on the design stationing and follows the UT from the northern to the southern property boundary (upstream to downstream) as depicted on the survey plat.

Particle size distribution protocols followed the Wolman Pebble Count Procedure, which requires an observer with a metric ruler measure particles based on their intermediate axis. This information is correlated into a graph depicting a particle size analysis of the cross section.

Vegetation assessments were conducted using the CVS-EEP protocol (Version 4.2). As part of this protocol, vegetation is assessed using 100-meter^2 plots, or modules. The scientific method requires that measurements be as unbiased as possible, and that they be repeatable. Plots are designed to achieve both of these objectives; in particular, different people should be able to inventory the same plot and produce similar data (Lee et. al., 2006).

According to Lee et. al. (2006), there are many different goals in recording vegetation, and both time and resources for collecting plot data are extremely variable. To provide appropriate flexibility in project design, the CVS-EEP protocol supports five distinct types of vegetation plot records, which are referred to as levels in recognition of the increasing level of detail and complexity across the sequence. The lower levels require less detail and fewer types of information about both vegetation and environment, and thus are generally sampled with less time and effort (Lee et. al., 2006). Level 1 (Planted Stem Inventory Plots) and Level 2 (Total Woody Stem Inventory Plots) inventories were completed on all 12 of the vegetation plots at the Project Site.

A crest gage was installed near the downstream end of the Site along the UT. This gage will verify the on-site occurrences of bankfull events. In addition to the crest gage, observations of wrack and deposition will also serve to validate gage observations, as necessary. Documentation of the highest stage during the monitoring interval will be assessed during each Site visit and the gage will be reset. The data related to bankfull verification will be summarized in each year's report. Based on the elevation of the crest gage, any readings observed higher than 22 inches on the gage will reflect a bankfull or above bankfull event.

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts and T.R. Wentworth, 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

NCDENR Division of Water Quality (NCDWQ) , 2005. Cape Fear River Basinwide Management Plan. Available at: http://portal.ncdenr.org/web/wq/ps/bpu/basin/capefear.

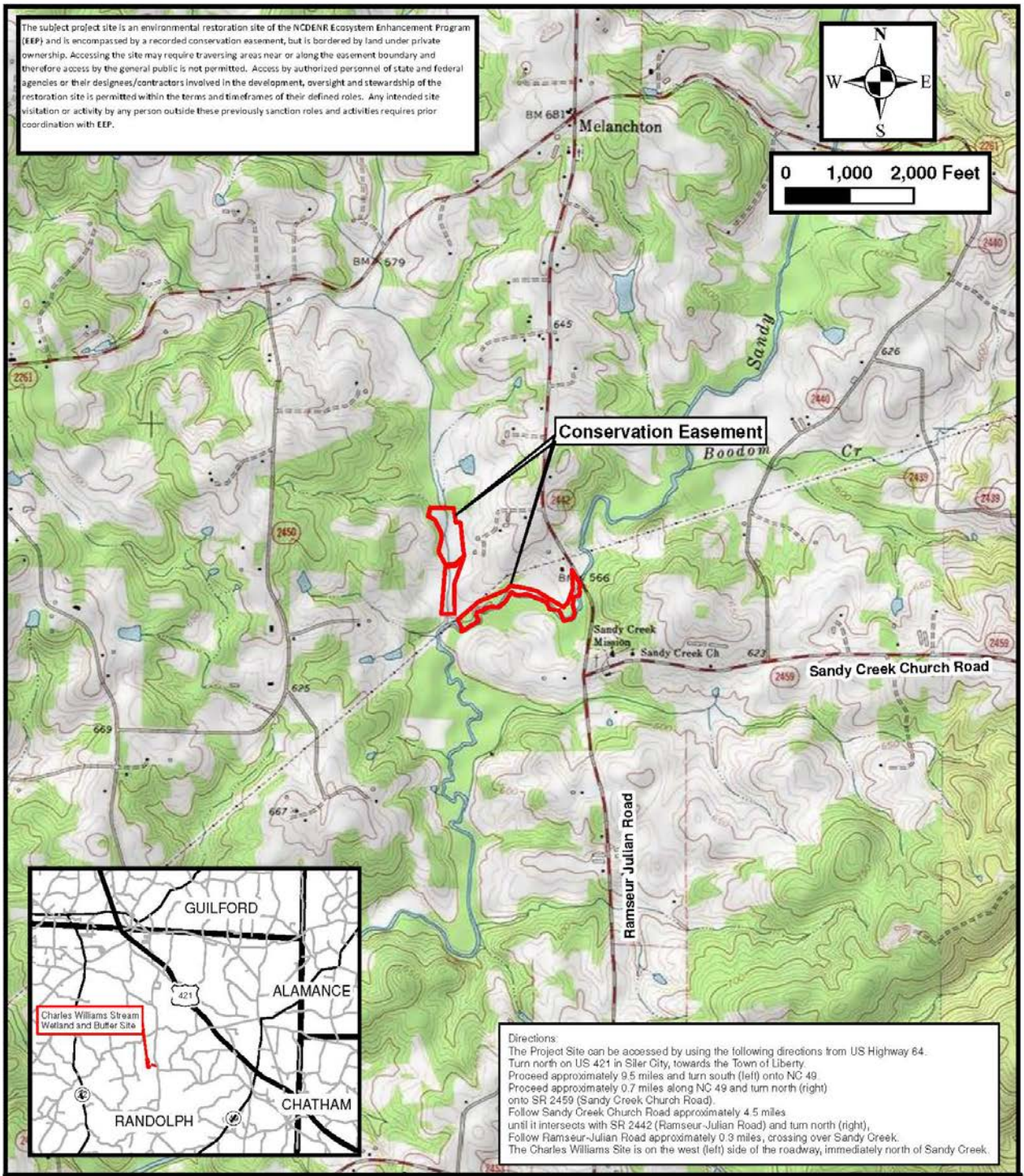
NCDENR Ecosystem Enhancement Program, 2013. Charles Williams Stream, Wetland, and Buffer Site Baseline Monitoring Document and As-built Baseline Report. Prepared by Ecological Engineering, LLP.

NC State Climate Office, 2014. Daily Precipitation Data from Siler City Airport (SILR), Chatham County (www.nc-climate.ncsu.edu).

US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission and NC Department of Environment Division of Water Quality, 2003. Stream Mitigation Guidelines.

APPENDIX A.

Project Vicinity Map and Background Tables



Prepared By: ECOLOGICAL ENGINEERING
1151 SE Cary Parkway, Suite 101
Cary, NC 27518
919-557-0929

Prepared For: NCEEP
217 West Jones St.
Suite 3000A
Raleigh, NC 27603

Charles Williams Site
Vicinity Map
Randolph County, NC
EEP Contract No. D08035S
July 2013

Source: USGS Quadrangle Maps (Grays Chapel)

FIGURE 1

Table 1. Project Components and Mitigation Credits

Charles Williams Stream, Wetland and Buffer Site / 80

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals		1,233		1.1			336,430		

Project Components

Project Component	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Stream Enhancement	10+00 to 27+53	1,850 linear feet	EI	RE	1,233	1.5 : 1
Riparian Wetland Enhancement	areas east and west of UT to Sandy Creek	2.2 acres	E	RE	1.1	2 : 1
Buffer Restoration (TOB - 50')	Sandy Creek and UT to Sandy Creek	201,481 square feet	R	R	201,481	1 : 1
Buffer Restoration (50' - 100')	Sandy Creek and UT to Sandy Creek	119,203 square feet	R	R	119,203	1 : 1
Buffer Restoration (101' - 200')	Sandy Creek and UT to Sandy Creek	63,704 square feet	R	R	15,926	4 : 1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration					384,208	
Enhancement		2.2				
Enhancement I	1,850					
Enhancement II						
Creation						
Preservation						
HQ Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements

BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Dentention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer.

Table 2. Project Activity and Reporting History

Charles Williams Stream Wetland and Buffer Site / 80

Elapsed Time Since Grading Complete (Feb 2013): 1 year, 1 month

Elapsed Time Since Planting Complete (Feb 2014): 1 month

Number of Reporting Years: 1

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September-08	May-09
Final Design - Construction Plans	November-09	April-12
Construction		February-13
Temporary S&E Mix Applied to Entire Project Area		January-13
Permanent Seed Mix Applied to Entire Project Area		January-13
Live Stake Plantings Applied		January-13
Bare-rooted Planting Applied		February-14
Baseline Monitoring Document	June-13	July-13
Year 1 Monitoring	March-14	May-14
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring (vegetation only)		

Table 3. Project Contact Table

Charles Williams Stream Wetland and Buffer Site / 80

Designer Ecological Engineering, LLP Jenny S. Fleming, PE	Firm Information/ Address 1151 SE Cary Parkway, Suite 101, Cary, NC 27518 (919) 557-0929
Construction Contractor Riverworks, Inc. Bill Wright	Firm Information/ Address 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Hauling Contractor Strader Fencing, Inc.	Firm Information/ Address 5434 Amick Road, Julian, NC 27283 (336) 697-7005
Planting Contractor(s) Carolina Silvics, Inc. (bare-rooted & containerized) Mary-Margaret S. McKinney, RF, PWS Riverworks, Inc. (livestakes only) George Morris	Firm Information/ Address 908 Indian Trail Road, Edenton, NC 27932 (252) 482.8491 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Seeding Contractor Strader Fencing, Inc. Kenneth L. Strader	Firm Information/ Address 5434 Amick Road, Julian, NC 27283 (336) 697-7005
Seed Mix Sources	Green Resource, LLC (336) 855-6363
Nursery Stock Suppliers (live stakes only)	Native Roots Nursery (910) 385-8385 NC Forest Service Tree Nursery (919) 731-7988 Foggy Mountain Nursery (336) 384-5323 Mellow Marsh Farm (919) 742-1200
Monitoring Performer Ecological Engineering, LLP Lane Sauls (stream, vegetation & wetland)	Firm Information/ Address 1151 SE Cary Parkway, Suite 101, Cary, NC 27518 (919) 557-0929

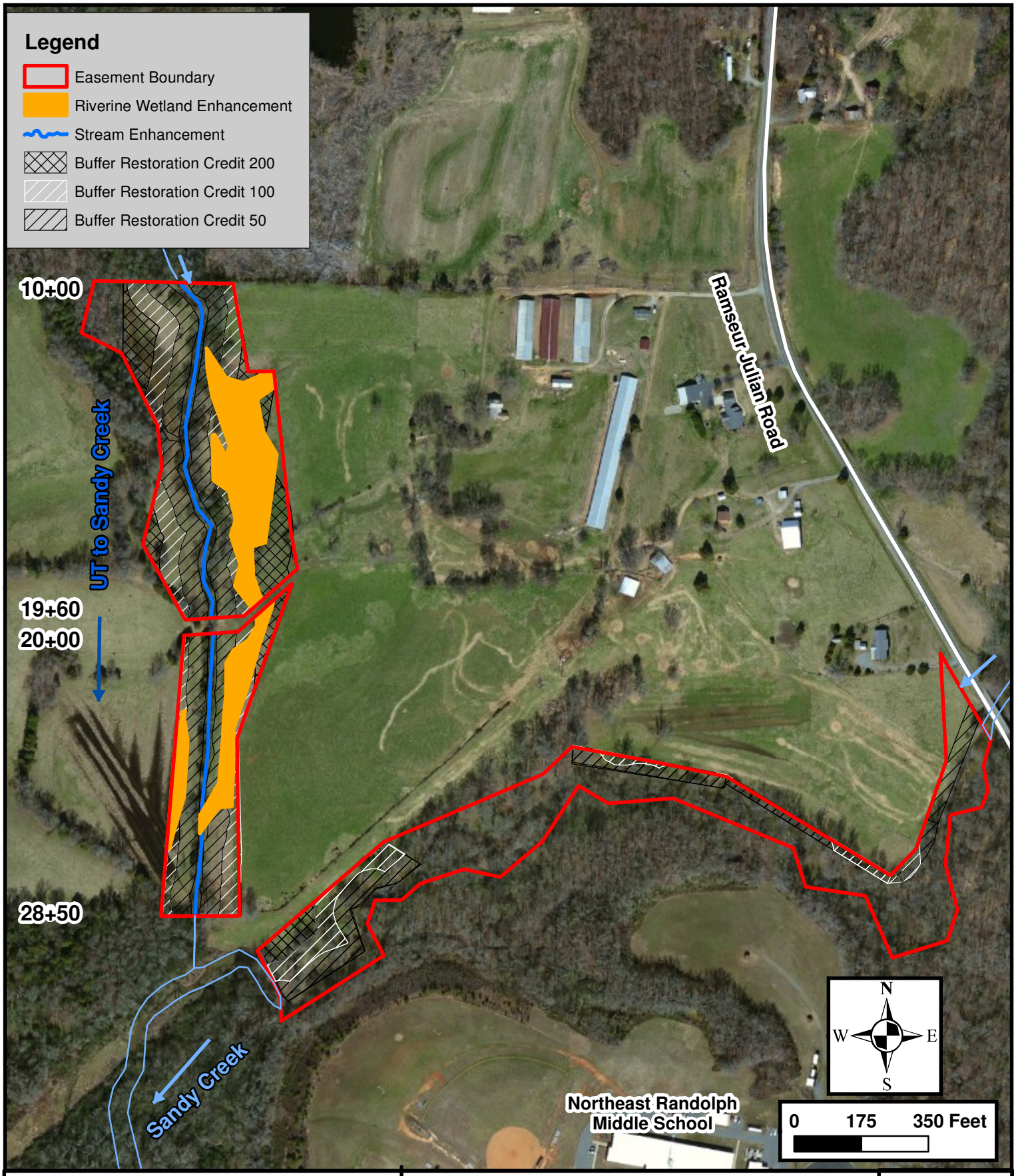
Table 4. Project Baseline Information and Attributes

Charles Williams Stream Wetland and Buffer Site / 80

Project Information	
Project Name	Charles Williams Stream Wetland and Buffer Site
County	Randolph
Project Area	18 acres
Project Coordinates (latitude and longitude)	35°49'31.95" North/ 79°39'02.64" West
Project Watershed Summary Information	
Physiographic Province	Piedmont
River Basin	Cape Fear
USGS Hydrologic Unit 8-digit: 03030003	USGS Hydrologic Unit 14-digit: 03030003020010
DWQ Subbasin	03-06-09
Project Drainage Area	4.9 sq. mi.
Project Drainage Area Percentage of Impervious Area	5 to 6%
CGIA Land Use Classification	Agricultural Land
Reach Summary Information	
Length of Reach	1,753 linear feet
Valley Classification	Valley Type VIII
Drainage Area	4.9 sq. mi.
NCDWQ Stream ID Score	>50
NCDWQ Water Quality Classification	WS-III
Morphological Description (stream type)	C5
Evolutionary Trend	C-G-F-E-C
Underlying Mapped Soils	Chewacla loam
Drainage Classification	Poorly drained
Soil Hydric Status	Hydric B
Slope	0 to 2%
FEMA Classification	Zone AE
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasive Species	Less than 5%
Wetland Summary Information	
Size of Wetland	1.96 acres
Wetland Type	Riverine
Mapped Soil Series	Chewacla loam
Drainage Classification	Somewhat poorly drained
Soil Hydric Status	Hydric B
Source of Hydrology	Overbank flooding
Hydrologic Impairment	None
Native Vegetation Community	Piedmont Alluvial Forest
Percent Composition of Exotic Invasive Species	Less than 5%
Regulatory Considerations	
Waters of the United States - Section 404	Resolved
Waters of the United States - Section 401	Resolved
Endangered Species Act	Resolved
Historic Preservation Act	Resolved
Coastal Zone/Area Management Acts (CZMA/CAMA)	Not Applicable
FEMA Floodplain Compliance	Resolved
Essential Fisheries Habitat	Not Applicable

APPENDIX B.

Visual Assessment Data



Prepared By: ECOLOGICAL ENGINEERING
1151 SE Cary Parkway, Suite 101
Cary, NC 27518
919-557-0929

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217 West Jones St.
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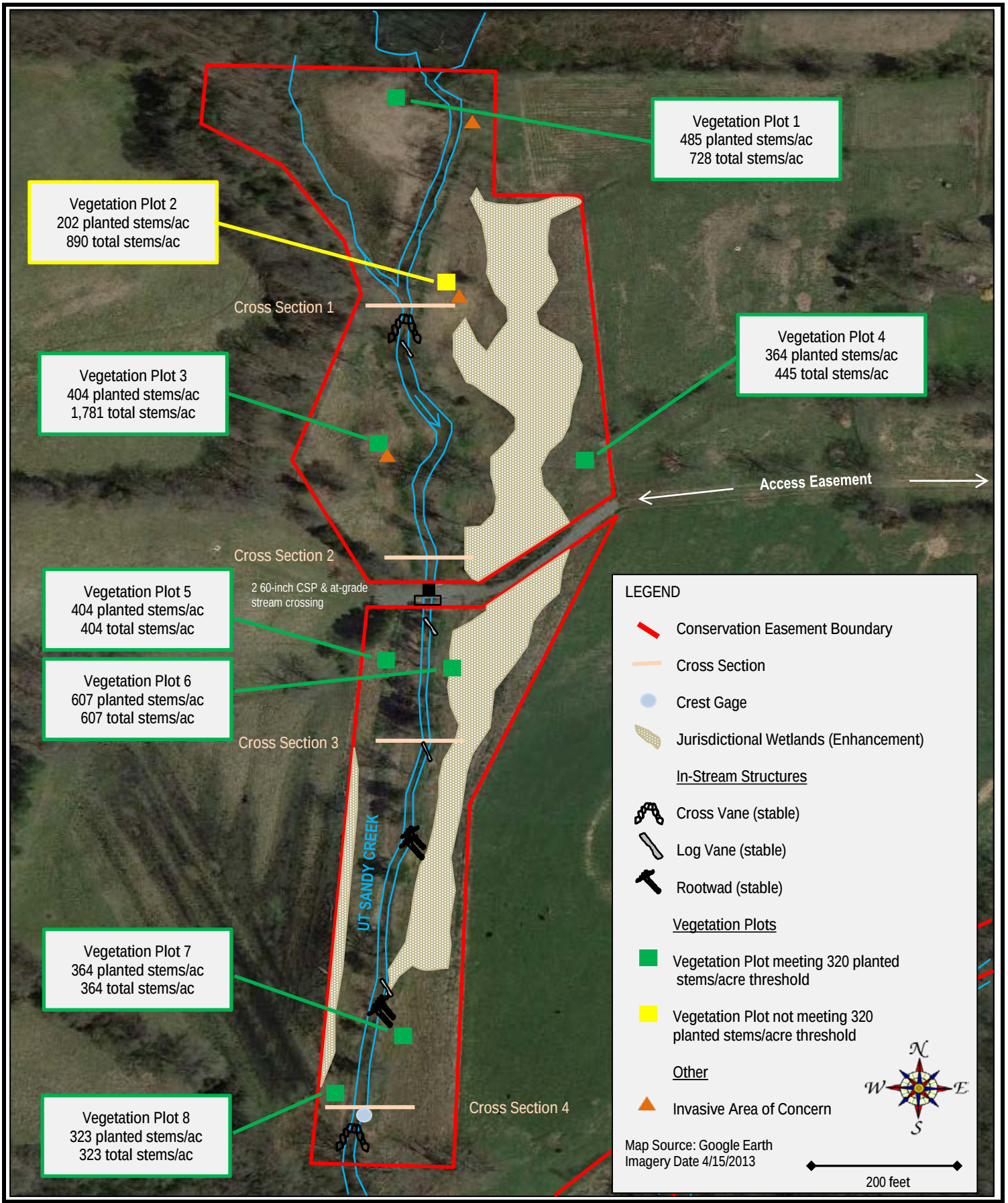
Raleigh, NC 27603

Charles Williams Site
Mitigation Components
Randolph County, NC
EEP Contract No. D08035S
May 2014

FIGURE 2



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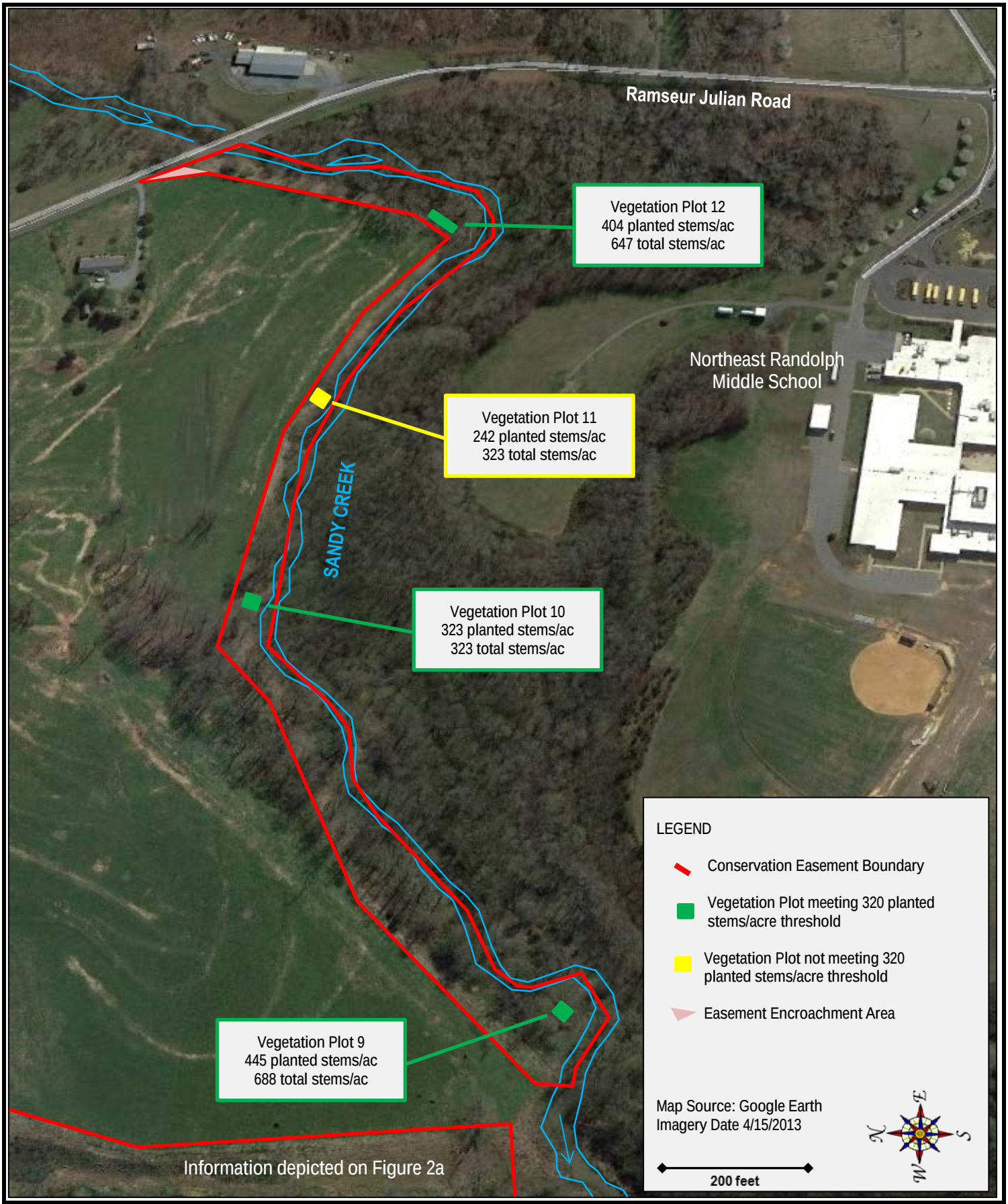
CURRENT CONDITIONS PLAN VIEW

Charles Williams Stream, Wetland, and Buffer Site, Randolph County, NC

EEP Project No. 80 June 3, 2014

FIGURE 3a



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CURRENT CONDITIONS PLAN VIEW

Charles Williams Stream, Wetland, and Buffer Site, Randolph County, NC

EEP Project No. 80 June 3, 2014

FIGURE 3b

Table 5. Visual Stream Morphology Assessment

Assessed Length: 1,850 linear feet

Charles Williams Stream, Wetland, and Buffer Site / 80

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
Bed	Vertical Stability	Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100			
		Degradation - Evidence of down-cutting.			0	0	100			
	Riffle Condition	Texture/Substrate - Riffle maintains coarser substrate.			0	0	100			
	Meander Pool Condition	Depth - Sufficient (Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6).	4	5			80			
		Length - Appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	4	5			80			
	Thalweg Position	Thalweg centering at upstream of meander bend (run).	8	8			100			
		Thalweg centering at downstream of meander bend (glide).	8	8			100			
Bank	Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100	none	none	n/a
	Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100	none	none	n/a
	Mass Wasting	Bank slumping, calving, or collapse.			0	0	100	none	none	n/a
				Totals	0	0	96	n/a	n/a	n/a
Engineered Structures	Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			8			
	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			3			
	Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			8			
	Bank Protection	Bank erosion with the structures extent of influence does NOT exceed 15% .	8	8			8			
	Habitat	Pool forming structures maintaining - Max. Pool Depth : Mean Bankfull Depth ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	3	3			3			

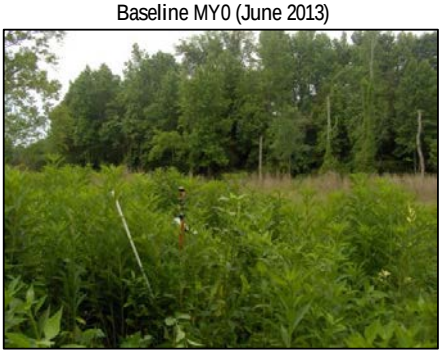
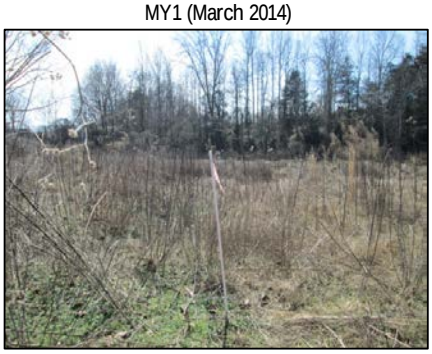
Table 6. Vegetation Condition Assessment

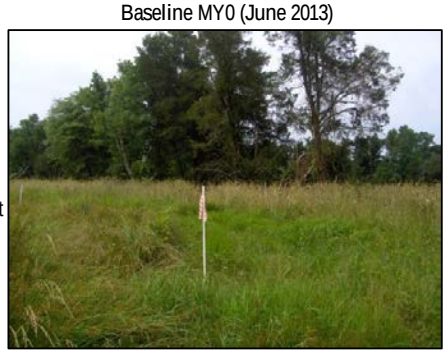
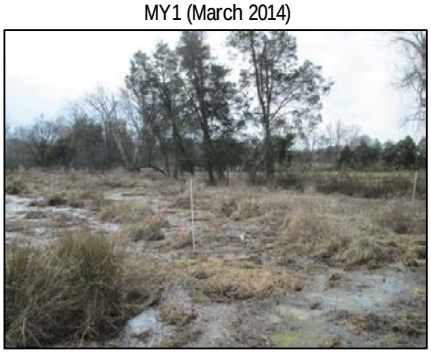
Charles Williams Stream, Wetland, and Buffer Site / 80

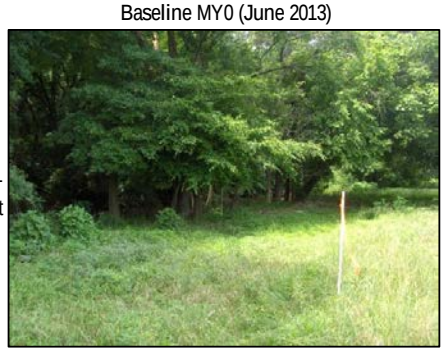
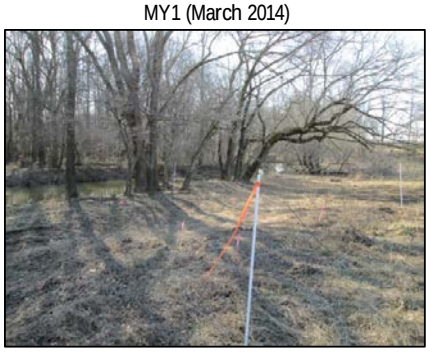
Planted Acreage:	16 acres					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	n/a	n/a	n/a	n/a
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria.	0.1 acres	n/a	n/a	n/a	n/a
			Total	n/a	n/a	n/a
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	n/a	n/a	n/a	n/a
			Cumulative Total	n/a	n/a	n/a
Estimated Acreage:	18 acres					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 SF	See CCPV	3	<.1 acres	<1 %
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	1,000 SF	See CCPV	1	0.2 acres	<1%

Charles Williams Stream, Wetland, and Buffer Site / 80

Annual Photograph Comparison

	Baseline MY0 (June 2013)	MY1 (March 2014)
Vegetation Plot 1 Facing Southwest		
Vegetation Plot 2 Facing Southwest		
Vegetation Plot 3 Facing Southwest		
Vegetation Plot 4 Facing Southwest		
Vegetation Plot 5 Facing Southwest		

	Baseline MY0 (June 2013)	MY1 (March 2014)
Vegetation Plot 6 Facing Southwest		
Vegetation Plot 7 Facing Southwest		
Vegetation Plot 8 Facing Southwest		
Vegetation Plot 9 Facing Southwest		
Vegetation Plot 10 Facing Southwest		

	Baseline MY0 (June 2013)	MY1 (March 2014)
Vegetation Plot 11 Facing Southwest		
Vegetation Plot 12 Facing Southwest		
Cross Section 1 Facing West		
Cross Section 1 Facing Downstream		
Cross Section 2 Facing West		

	Baseline MY0 (June 2013)	MY1 (March 2014)
Cross Section 2 Facing Downstream		
Cross Section 3 Facing West		
Cross Section 3 Facing Downstream		
Cross Section 4 Facing West		
Cross Section 4 Facing Downstream		

APPENDIX C.

Vegetation Plot Data

PLANTING LIST ASCERTAINED FROM EEP

Sandy Creek (Charles Williams)

Species	Type	Riparian		Wetland		Nursery
		Qty	%	Qty	%	
Betula nigra	2-0 BR	300	10%	100	11%	NCFS
Carya glabra	2-0 BR	100	3%			NCFS
Carya tomentosa	2-0 BR	200	7%			NCFS
Fraxinus pennsylvanica	2-0 BR	275	9%	100	11%	NCFS
Liriodendron tulipifera	2-0 BR	400	13%			NCFS
Platanus occidentalis	2-0 BR	225	7%	200	23%	NCFS
Quercus falcata var. pagodiafolia	2-0 BR	300	10%	100	11%	NCFS
Quercus nigra	2-0 BR			100	11%	NCFS
Quercus phellos	2-0 BR	600	20%	200	23%	NCFS
Quercus rubra	2-0 BR	300	10%			NCFS
Amelanchier arborea	1-gal	25	1%			Native Roots
Carpinus caroliniana	1-gal	85	3%			Native Roots
Chionanthus virginicus	1-gal	64	2%			Native Roots
Diospyros virginiana	2-0 BR	200	7%			NCFS
Ilex verticillata	1-gal			37	4%	Native Roots
Magnolia virginiana	1-gal			38	4%	Native Roots
		3,074	100%	875	100%	

Table 7. Vegetation Plot Criteria Attainment

Charles Williams Stream, Wetland, and Buffer Site / 80

Vegetation Plot ID	Stream/Wetland Vegetation Survival Threshold Met?	Buffer Vegetation Survival Threshold Met?	Tract Mean
1	Yes	Yes	
2	No	No	
3	Yes	Yes	
4	Yes	Yes	
5	Yes	Yes	
6	Yes	Yes	Stream/Wetland Veg. = 67%
7	Yes	Yes	Buffer Veg. = 100%
8	Yes	Yes	
9	n/a	Yes	
10	n/a	Yes	
11	n/a	No	
12	n/a	Yes	

Note:

All Vegetation Plots aside from Plots #1 and #2 exhibit unidentified planted hardwood stems. These counts were included in the MY1 assessments. Species identification will be conducted on those unknown stems during the growing season associated with MY2 activities.

Table 8. CVS Vegetation Plot Metadata

Charles Williams Stream, Wetland, and Buffer Site / 80

Report Prepared By	Lane Sauls
Date Prepared	3/17/2014 16:39
database name	SandyCreekCharlesWilliams_80_RandolphCounty_Year 0.mdb
database location	P:\10000 Consultants\10227 Sungate\10227-017_Charles Williams Monitoring\CVS Database
computer name	LSAULSPC
file size	62709760

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------	
Project Code	80
project Name	Sandy Creek - Charles Williams
Description	Stream, Wetland and Buffer
River Basin	Cape Fear
length(ft)	1,753
stream-to-edge width (ft)	5 to 12
area (sq m)	1,302
Required Plots (calculated)	12
Sampled Plots	12

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means

Charles Williams Stream, Wetland, and Buffer Site / 80

Scientific Name	Common Name	Species Type	Current Plot Data (MY0 2014)																																	Annual Means		
			080-01-0001			080-01-0002			080-01-0003			080-01-0004			080-01-0005			080-01-0006			080-01-0007			080-01-0008			080-01-0009			080-01-0010			080-01-0011			080-01-0012			MY0 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																										5						2			6			13
Betula nigra	river birch	Tree				1	1	1	4	4	4				1	1	1	1	1	1	2	2	2	1	1	1	1	1	1										11	11	11
Carpinus caroliniana	American hornbeam	Tree																									2	2	2										2	2	2
Carya	hickory	Tree													2	2	2							1	1	1										1	1	1	4	4	4
Diospyros virginiana	common persimmon	Tree																											1	1	1							1	1	1
Fraxinus pennsylvanica	green ash	Tree	12	12	12	4	4	4	2	2	2	1	1	1	1	1	1	5	5	5	1	1	1				4	4	4	3	3	3							33	33	33
Ligustrum	privet	Exotic						17																																	17
Ligustrum sinense	Chinese privet	Exotic			1						16																	1													18
Liquidambar styraciflua	sweetgum	Tree			5																																				5
Liriodendron tulipifera	tuliptree	Tree																			2	2	2														1	1	1	3	3	3
Magnolia virginiana	sweetbay	Tree																2	2	2																				2	2	2
Platanus occidentalis	American sycamore	Tree												2																											2
Quercus	oak	Tree							1	1	1	7	7	7				4	4	4	1	1	1	1	1	1	1	1	1	3	3	3	5	5	5	7	7	7	30	30	30
Salix nigra	black willow	Tree									18																														18
Unknown		Shrub or Tree							3	3	3	1	1	1	6	6	6	3	3	3	3	3	3	5	5	5	3	3	3	1	1	1	1	1	1	1	1	1	27	27	27
		Stem count	12	12	18	5	5	22	10	10	44	9	9	11	10	10	10	15	15	15	9	9	9	8	8	8	11	11	17	8	8	8	6	6	8	10	10	16	113	113	186
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			1			12		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.30		
		Species count	1	1	3	2	2	3	4	4	6	3	3	4	4	4	4	5	5	5	5	5	5	4	4	4	5	5	7	4	4	4	2	2	3	4	4	5	9	9	15
		Stems per ACRE	485.6	485.6	728.4	202.3	202.3	890.3	404.7	404.7	1781	364.2	364.2	445.2	404.7	404.7	404.7	607	607	607	364.2	364.2	364.2	323.7	323.7	323.7	445.2	445.2	688	323.7	323.7	323.7	242.8	242.8	323.7	404.7	404.7	647.5	381.1	381.1	627.3

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

APPENDIX D.

Stream Survey Data

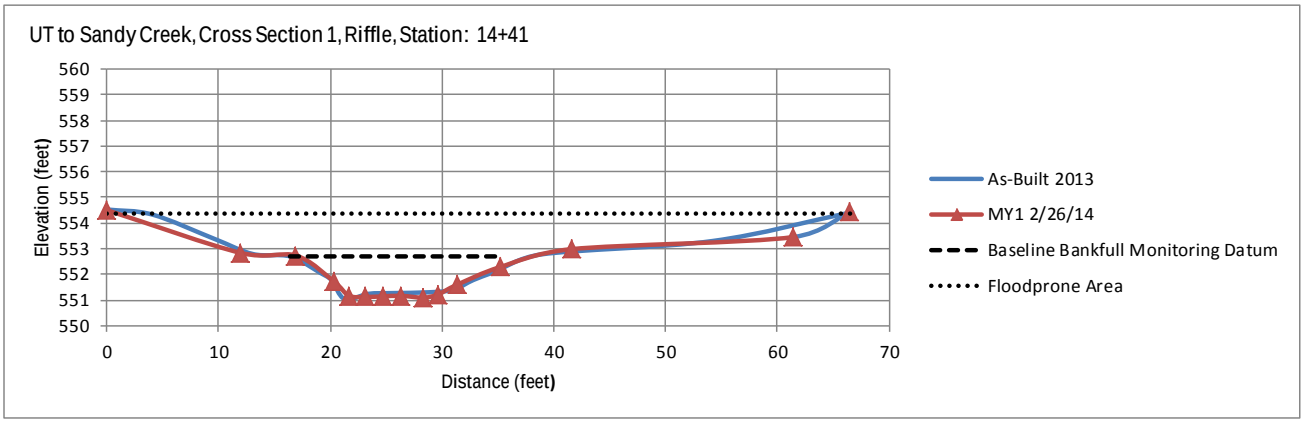
Cross Section Plot Exhibits

River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 1, Riffle, STA. 14+41
Drainage Area (sq mi):	4.9
Date:	2/26/2014
Field Crew:	E. Hajnos, R. Robol

SUMMARY DATA	
Bankfull Elevation:	552.7
Bankfull Cross Sectional Area:	22.5
Bankfull Width:	22.6
Flood Prone Area Elevation:	554.4
Flood Prone Width:	54.5
Max. Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.0
Width/Depth Ratio:	22.7
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0

Station	Elevation
0.0	554.5
12.0	552.8
16.9	552.7
20.3	551.7
21.7	551.2
23.2	551.1
24.7	551.1
26.3	551.2
28.3	551.1
29.6	551.2
31.4	551.6
35.2	552.3
41.5	553.0
61.4	553.5
66.5	554.4

Stream Type:	C5	Photograph facing downstream @ XS 1

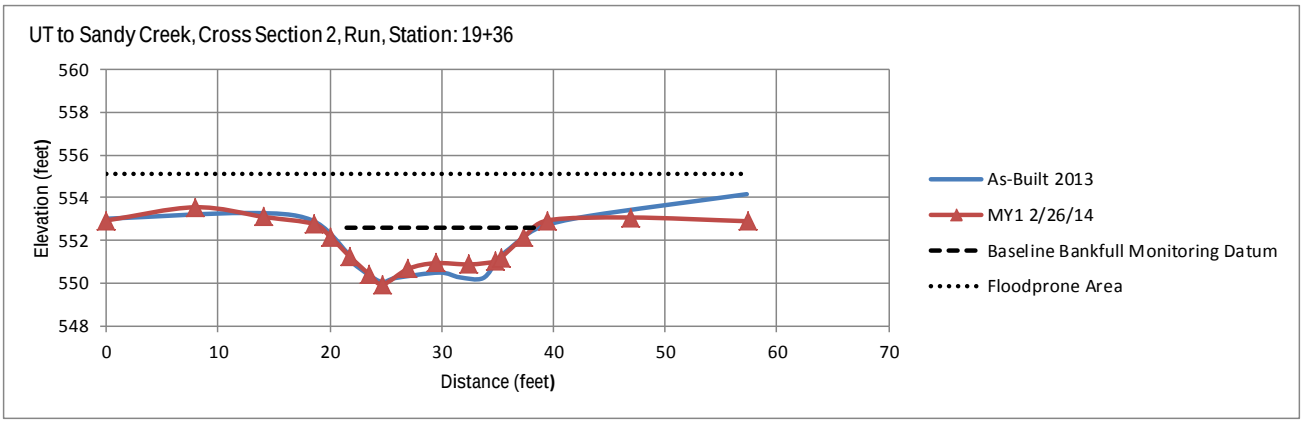


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 2, Glide, STA. 19+36
Drainage Area (sq mi):	4.9
Date:	2/26/2014
Field Crew:	E. Hajnos, R. Robol

SUMMARY DATA	
Bankfull Elevation:	552.8
Bankfull Cross Sectional Area:	32.8
Bankfull Width:	20.5
Flood Prone Area Elevation:	555.6
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.6
Width/Depth Ratio:	12.9
Entrenchment Ratio:	>10
Bank Height Ratio:	1.1

Station	Elevation
0.0	552.9
7.9	553.6
14.1	553.1
18.5	552.8
20.1	552.2
21.8	551.2
23.5	550.4
24.7	550.0
27.0	550.7
29.4	550.9
32.5	550.9
34.8	551.0
35.3	551.2
37.4	552.2
39.5	552.9
47.0	553.1
57.4	552.9

Stream Type:	C5	Photograph facing downstream @ XS 2

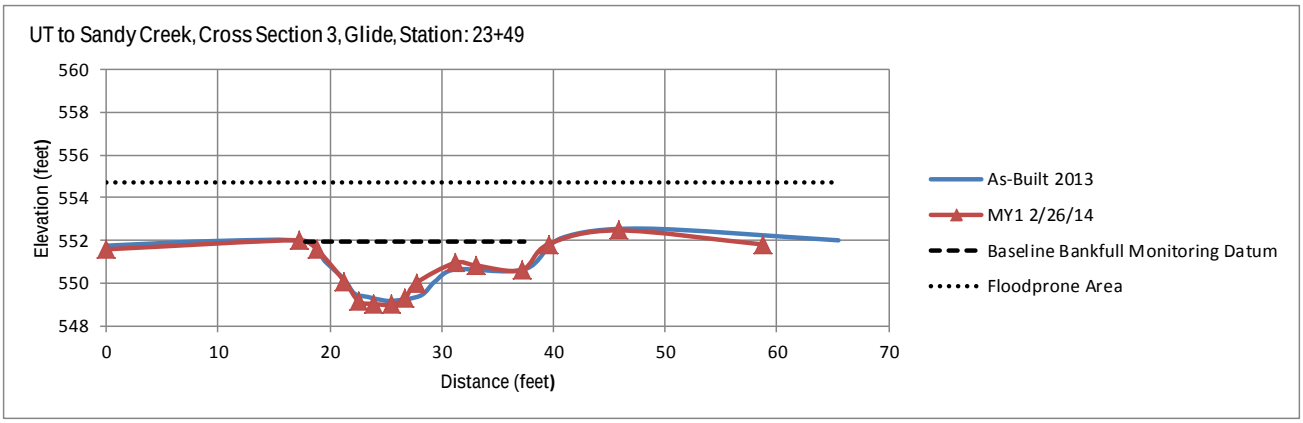


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 3, Run, STA. 23+49
Drainage Area (sq mi):	4.9
Date:	2/26/2014
Field Crew:	E. Hajnos, R. Robol

SUMMARY DATA	
Bankfull Elevation:	551.8
Bankfull Cross Sectional Area:	24.5
Bankfull Width:	17.8
Flood Prone Area Elevation:	554
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.4
Width/Depth Ratio:	12.9
Entrenchment Ratio:	>8
Bank Height Ratio:	1

Station	Elevation
0.0	551.6
17.3	552.0
18.8	551.6
21.3	550.1
22.6	549.2
23.9	549.0
25.5	549.0
26.7	549.3
27.8	550.0
31.2	550.9
33.1	550.8
37.2	550.6
39.6	551.8
45.8	552.5
58.8	551.8

Stream Type:	C5	Photograph facing downstream @ XS 3

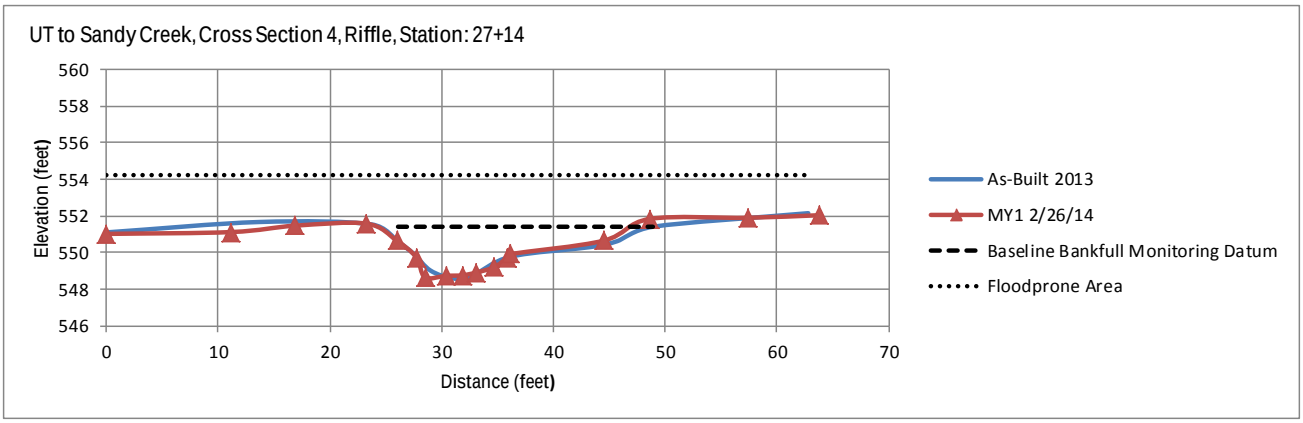


River Basin:	Cape Fear
Watershed:	UT Sandy Creek, MY-01
XS ID:	XS 4, Riffle, STA. 27+14
Drainage Area (sq mi):	4.9
Date:	2/26/2014
Field Crew:	E. Hajnos, R. Robol

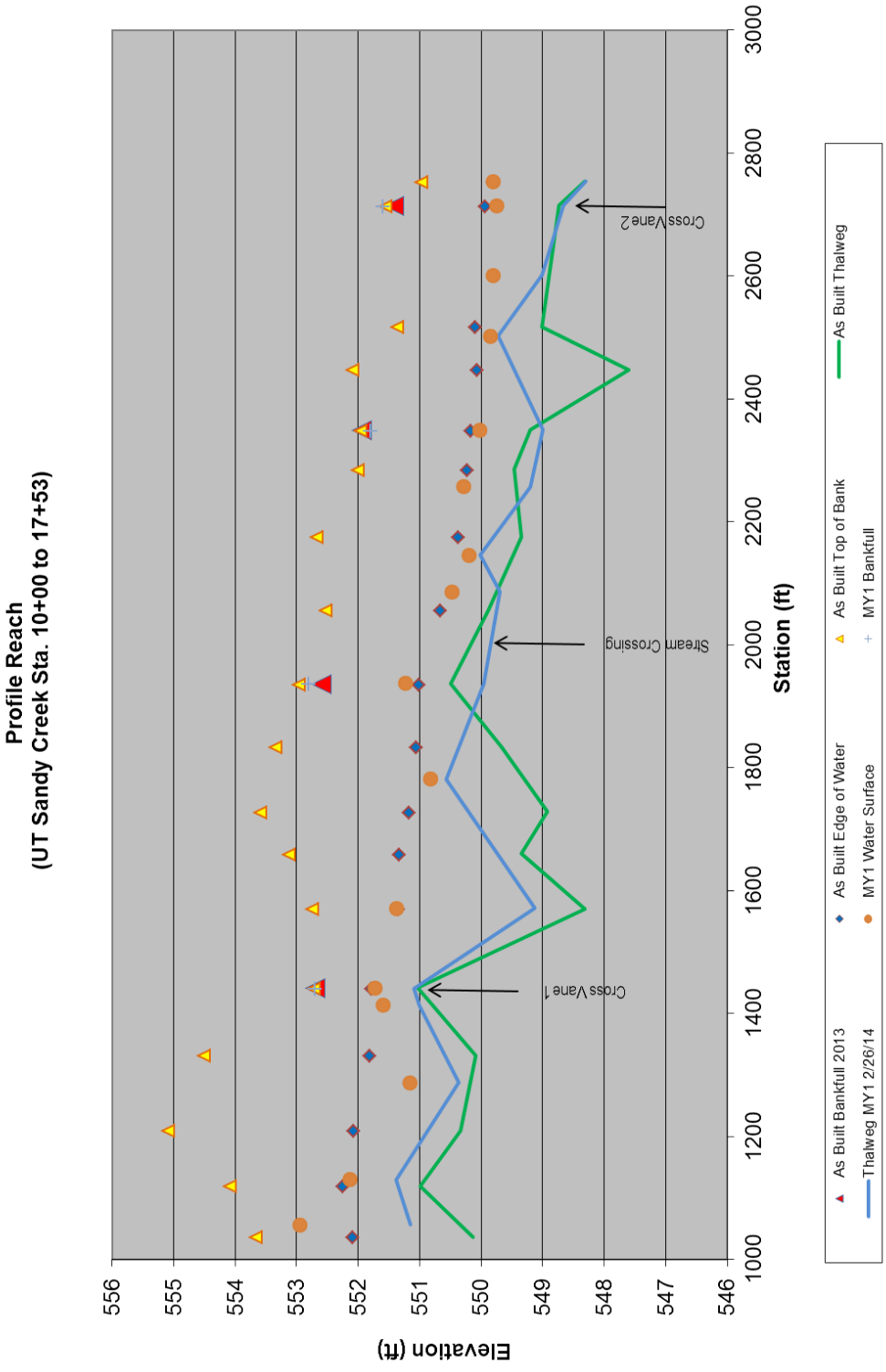
SUMMARY DATA	
Bankfull Elevation:	551.6
Bankfull Cross Sectional Area:	37.8
Bankfull Width:	24.5
Flood Prone Area Elevation:	554.5
Flood Prone Width:	200+
Max. Depth at Bankfull:	2.9
Mean Depth at Bankfull:	1.5
Width/Depth Ratio:	15.8
Entrenchment Ratio:	>8.0
Bank Height Ratio:	0.4

Station	Elevation
0.0	551.0
11.2	551.1
16.9	551.5
23.3	551.6
26.0	550.7
27.7	549.8
28.5	548.7
30.4	548.7
31.9	548.8
33.1	548.9
34.7	549.2
35.9	549.8
36.2	549.9
44.5	550.7
48.6	551.9
57.4	551.9
63.8	552.1

Stream Type:	C5	Photograph facing downstream @ XS 4



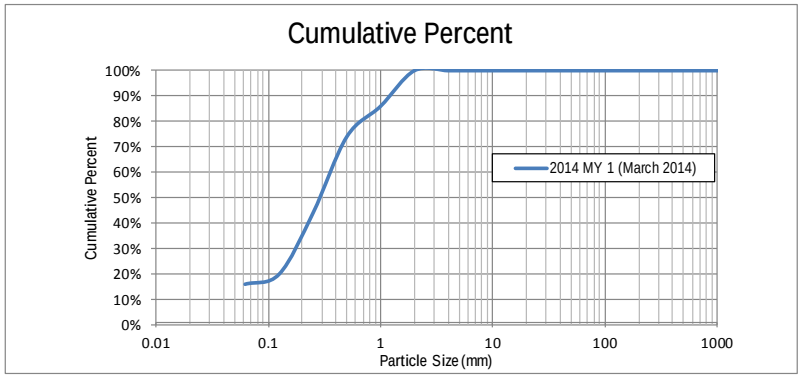
Longitudinal Profile Plot Exhibit

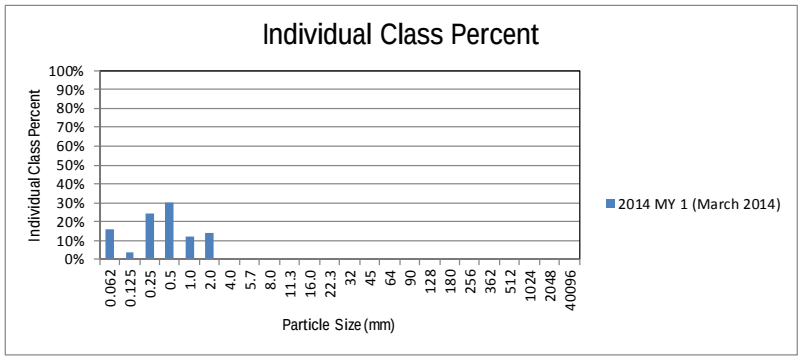


Cross Section Pebble Count Exhibits

Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 1 Feature: Riffle					
			2014 MY 1 (March 2014)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	16%	16%
Sand	very fine sand	0.125	2	4%	20%
	fine sand	0.25	12	24%	44%
	medium sand	0.5	15	30%	74%
	coarse sand	1.0	6	12%	86%
	very coarse sand	2.0	7	14%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

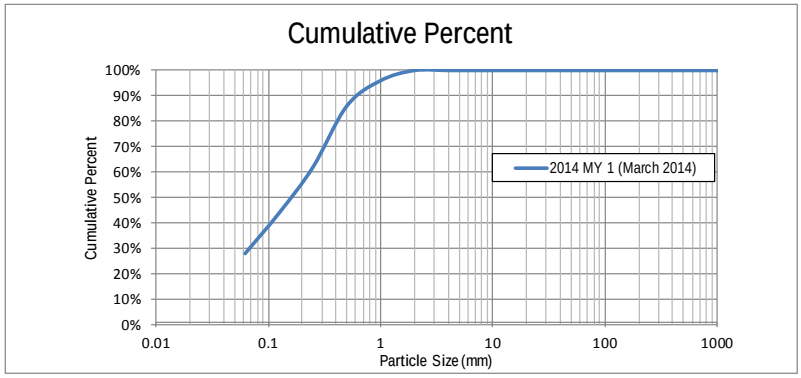
Summary Data	
D50	0.29 mm
D84	0.55 mm
D95	1.5 mm

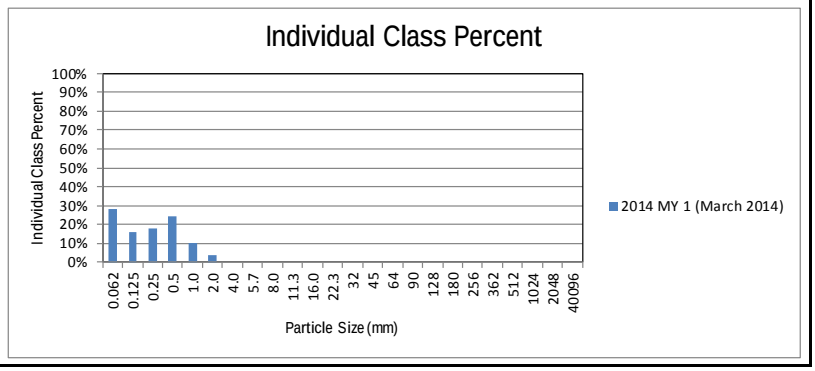




Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 2 Feature: Glide					
			2014 MY 1 (March 2014)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	14	28%	28%
Sand	very fine sand	0.125	8	16%	44%
	fine sand	0.25	9	18%	62%
	medium sand	0.5	12	24%	86%
	coarse sand	1.0	5	10%	96%
	very coarse sand	2.0	2	4%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

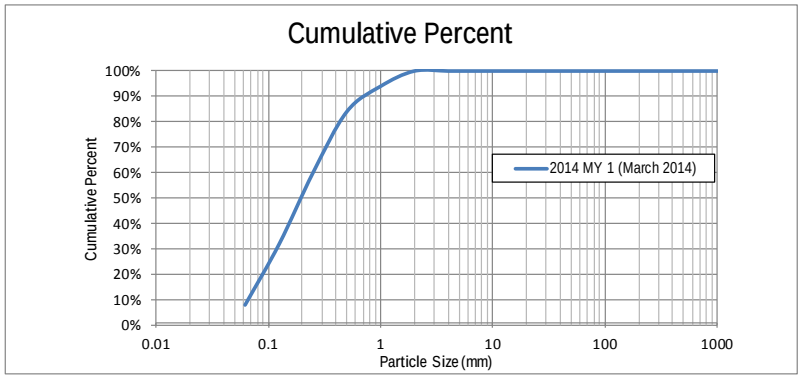
Summary Data	
D50	0.16 mm
D84	0.50 mm
D95	1.0 mm

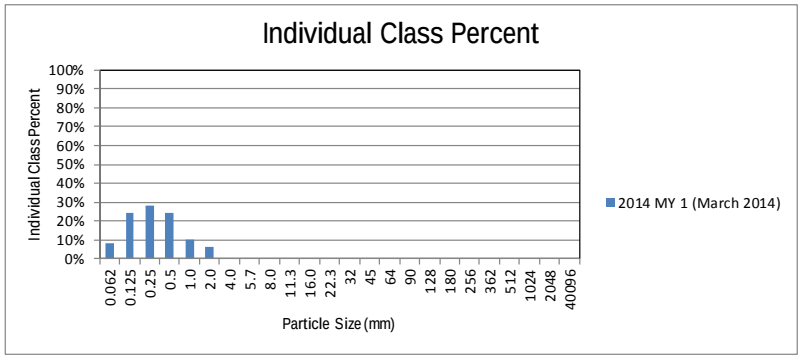




Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 3 Feature: Run					
			2014 MY 1 (March 2014)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	8%	8%
Sand	very fine sand	0.125	12	24%	32%
	fine sand	0.25	14	28%	60%
	medium sand	0.5	12	24%	84%
	coarse sand	1.0	5	10%	94%
	very coarse sand	2.0	3	6%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

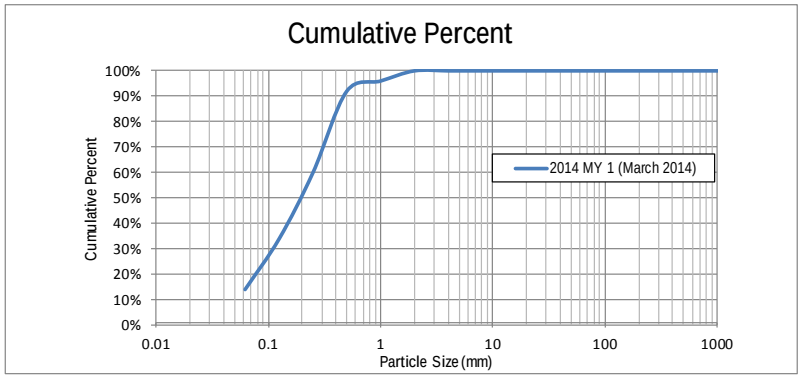
Summary Data	
D50	0.20 mm
D84	0.50 mm
D95	1.4 mm





Charles Williams Stream, Wetland, and Buffer Site / 80 Cross Section: 4 Feature: Riffle					
			2014 MY 1 (March 2014)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	7	14%	14%
Sand	very fine sand	0.125	10	20%	34%
	fine sand	0.25	13	26%	60%
	medium sand	0.5	16	32%	92%
	coarse sand	1.0	2	4%	96%
	very coarse sand	2.0	2	4%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	coarse gravel	22.3	0	0%	100%
	coarse gravel	32	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			50	100%	

Summary Data	
D50	0.20 mm
D84	0.40 mm
D95	0.6 mm



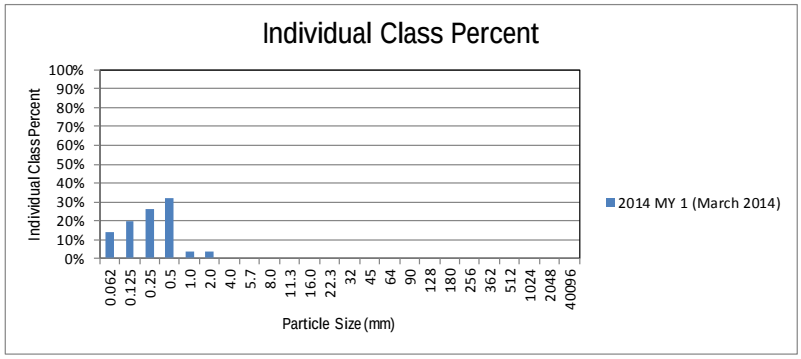


Table 10a. Baseline Stream Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)						25.2				1								25.2		22	23.5	24.9	24.9		2
Floodprone Width (ft)						>300				1								>300		63	>131	200+	200+		2
Bankfull Mean Depth (ft)						1.58				1								1.59		1	1.3	1.5	1.5		2
[1]Bankfull Max Depth (ft)						2.6				1								2.6		1.7	2.3	2.8	2.8		2
Bankfull Cross Sectional Area (ft^2)						40.0				1								40		21.7	28.9	36.1	36.1		2
Width/Depth Ratio						15.8				1								15.8		>15	>15	>15	>15		2
Entrenchment Ratio						>15				1								>15		2.9	7.5	8.4	>8		2
[1]Bank Height Ratio						1.0				1								1.0		1.0	1.0	1.0	1.0		2
Profile																									
Riffle Length (ft)																				39	51.5	51.5	64		2
Riffle Slope (ft/ft)						0.013				1								0.013		0.26	0.28	0.28	0.3		2
Pool Length (ft)					8.3	30.5		63.7										30.5		168	198	196	232	27.5	4
Pool Max depth (ft)						3.4				1								3.4		3.1	3.5	3.4	4.25		4
Pool Spacing (ft)					56.0	116.0		94.0										116.4		158	372	239	719		3
Pattern																									
Channel Beltwidth (ft)					31.7	44.9		62.3									31.7	44.9	62.3	40	74.5	78.5	101	24.8	4
Radius of Curvature (ft)					15.0	37.8		95.0									15	37.8	95	19	60.5	58	107	31.5	4
Rc:Bankfull width (ft/ft)					0.6	1.5		3.8									0.6	1.5	3.8	0.9	2.7	2.6	4.8	1.4	4
Meander Wavelength (ft)					73.0	133.8		216.0									73	133.8	216	86	149.25	121.5	268	70.1	4
Meander Width Ratio					2.9	5.3		8.6									1.3	1.8	2.5	3.9	6.7	5.5	12	3.1	4
Transport parameters																									
Reach Shear Stress (competency) lb/f^2						0.1425															0.07				
Max part size (mm) mobilized at bankfull						2.0															2.0				
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification						C5												C5			C5				
Bankfull Velocity (fps)						3.9												3.75			3.05				
Bankfull Discharge (cfs)						150.0																			
Valley length (ft)						1961																			
Channel Thalweg length (ft)						1850												1850			1850				
Sinuosity (ft)						1.06												1.06			1.06				
Water Surface Slope (Channel) (ft/ft)						0.0014												0.0014			0.0013				
BF slope (ft/ft)																		0.0013			0.0013				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%	1%	84%	4%	11%	0%																	11%	60%	14%	15%	0%		
[1]SC% / Sa% / G% / C% / B% / Be%	7%	83%	10%	0%	0%	0%																						
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.12	0.34	0.55	1.70	3.60	<2.0	<2.0																					
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	0	0	0	0	1850																	0	0	200	0	1650		
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0	1850	0	0	0																		1850	0	0	0			

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

	Cross Section 1 (Riffle)							Cross Section 2 (Glide)							Cross Section 3 (Run)							Cross Section 4 (Riffle)													
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																																			
Bankfull Width (ft)	22.0	22.6						19.6	20.5						22.6	18.8						24.9	24.5												
Floodprone Width (ft)	63.0	65.4						200+	200+						200+	200+						200+	200+												
Bankfull Mean Depth (ft)	1.0	1.0						1.7	1.6						1.6	1.5						1.5	1.5												
Bankfull Max Depth (ft)	1.7	1.6						2.5	2.8						2.8	2.8						2.8	2.9												
Bankfull Cross Sectional Area (ft^2)	21.7	22.5						33.4	32.8						36.4	29.0						36.1	37.8												
Bankfull Width/Depth Ratio	322.3	22.7						11.5	12.9						14.0	12.2						16.6	15.8												
Bankfull Entrenchment Ratio	2.9	2.9						>10.0	>10.0						>8.0	>8.0						>8.0	>8.0												
Bankfull Bank Height Ratio	1.0	1.0						1.1	1.1						1.0	1.0						1.0	1.0												
Based on current/developing bankfull feature[2]																																			
Record elevation (datum) used																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

These cells may or may not require population in any given year. See footnote 2 below

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

2 = Based on the elevation of any dominant depositional feature that develops and is observed at the time of survey. If the baseline datum remains the only significant depositional feature then these two sets of dimensional parameters will be equal, however, if another depositional feature of significance develops above or below the baseline bankfull datum then this should be tracked and quantified in these cells.

Table 11b. Monitoring Data - Stream Reach Data Summary

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	22	23.5	24.9	24.9		2	22.6		24.5	24.5		2																								
Floodprone Width (ft)	63	>131	200+	200+		2	65.4		200+	200+		2																								
Bankfull Mean Depth (ft)	1	1.3	1.5	1.5		2	1.0	1.3	1.5	1.5		2																								
[1]Bankfull Max Depth (ft)	1.7	2.3	2.8	2.8		2	1.6	2.5	2.9	2.9		2																								
Bankfull Cross Sectional Area (ft^2)	21.7	28.9	36.1	36.1		2	22.5	30.5	37.8	37.8		2																								
Width/Depth Ratio	>15	>15	>15	>15		2	>15	>15	>15	>15		2																								
Entrenchment Ratio	2.9	7.5	8.4	>8		2	2.9	>5.4	>8	>8		2																								
[1]Bank Height Ratio	1.0	1.0	1.0	1.0		2	1.0	1.0	1.0	1.0		2																								
Profile																																				
Riffle Length (ft)	39.0	51.5	51.5	64.0		2	53.13	75.34	78.7	91	14.5	6																								
Riffle Slope (ft/ft)	0.3	0.3	0.3	0.3		2	0.3	0.3	0.3	0.3	0.0	6																								
Pool Length (ft)	168.0	198.0	196.0	232.0	27.5	4	283.6	283.6	283.6	283.6	0.0	2																								
Pool Max depth (ft)	3.1	3.5	3.4	4.3		4	0.79	1.52	1.52	2.25		2																								
Pool Spacing (ft)	158.0	372.0	239.0	719.0		3	283.6	283.6	283.6	283.6		2																								
Pattern																																				
Channel Beltwidth (ft)	40.0	74.5	78.5	101.0	24.8	4																														
Radius of Curvature (ft)	19.0	60.5	58.0	107.0	31.5	4																														
Rc:Bankfull width (ft/ft)	0.9	2.7	2.6	4.8	1.4	4																														
Meander Wavelength (ft)	86.0	149.3	121.5	268.0	70.1	4																														
Meander Width Ratio	3.9	6.7	5.5	12.0	3.1	4																														
Additional Reach Parameters																																				
Rosgen Classification	C5						C5																													
Channel Thalweg length (ft)	1753						1754																													
Sinuosity (ft)	1.06						1.06																													
Water Surface Slope (Channel) (ft/ft)	0.0013						0.0013																													
BF slope (ft/ft)	0.0013						0.0013																													
[3]Ri% / Ru% / P% / G% / S%	5%	80%	15%				0.05	0.8	0.15																											
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0						0																													
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.

2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table

3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

4. = Of value/needed only if the n exceeds 3

APPENDIX E.

Hydrology Data

Table 12. Verification of Bankfull Events

Charles Williams Stream, Wetland, and Buffer Site / 80 - UT to Sandy Creek: 1,850 linear feet

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
11/6/2013	unknown	Crest Gage	Not Available
3/6/2014	unknown	Visual On-site (wrack)	Not Available